Pharmacoeconomic Analysis of Asthma in Pediatric Patients in Tertiary Care Hospital in Kerala

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ABSTRACT

Bronchial asthma is the most common chronic disease of childhood, responsible for a significant proportion of the abstinence from school. The objective of our study was to determine the total direct and indirect cost of asthma in pediatrics. The study design was prospective observational study. This study was carried out among the pediatrics aged (0-15), and a total of 158 patients were taken. A questionnaire is prepared based on GINA guidelines of asthma for data collection, the patients/caregivers are requested to answer the questionnaire. From 158 patients enrolled 110(70%) were males and 48(30%) were females. The direct cost of asthma was found to be 88.59% and indirect cost was found to be 11.4%. This study shows that the direct cost was very high as compared to indirect cost. The medication cost was found to be high 46.10% of total cost followed by hospitalization cost 30.14%. According to the degree of severity the moderate persistent asthma was found to be 39.49% of the total cost of asthma. Study revealed that the asthma hospitalization can be decreased as the inhalation therapy use increased.

Keywords: Asthma, Pharmacoeconomics, Direct cost, indirect cost

INTRODUCTION

Bronchial asthma is the most common chronic disease of childhood. In recent years a consistent increase in the prevalence of asthma has been reported from various regions of the world.[1] Pediatric asthma accounts for a large proportion of childhood hospitalization, physician visit, absenteeism from school and parental absence from work. Numerous factors affect the cost of childhood asthma, like disease severity, under treatment, inadequate preventive drug use and inadequate medication regimens, exposure to environmental agent and lack of education of patient's families and caregivers.[2] Prospective studies may be costly, take several years to complete, and require a sampling strategy that ensures generalizability of the results.[3]. Pharmacoeconomic studies are crucial, as now many third-party payers, such as government and private health-care plans, are requiring these studies to be performed in order to decide if they will reimburse the claim[4]. The social science of pharmacoeconomics is quite a new and rapidly changing field. The roots of pharmacoeconomics are in health economics – specialised aspect of economics developed in the1960s. The concepts involved in pharmacoeconomics, such as cost-effectiveness and cost-benefit analysis, have been developed from the late 1970s. Beginning in the 1980s, measurement tools for health and clinical outcomes assessment were created and have subsequently been improved[5]. Pharmacoeconomics addresses both economic and humanistic outcomes. Pharmacoeconomics includes ideas and methods from a variety of domains including statistics, clinical epidemiology, economics, decision analysis and psychometrics, etc. Pharmacoeconomics and outcomes research are two related disciplines that focus on these areas of investigation. The purpose of this study was to estimate the total direct and indirect cost of asthma in pediatrics[6].

MATERIALS AND METHODS

Patient sample

The study population consisted of any patient diagnosed with asthma as a primary disorder. The sampling was designed to include both in-patient and out-patient departments of tertiary care hospital in kerala.The project received ethics approval, and participants provided written informed consent. The method used was the prospective observational study. This study focused on 158 pediatric patients aged between 0-15 years, pediatric patients with asthma or symptoms of asthma, in-patient and out-patient asthma patients are included in this study and patients with other chronic conditions, patients admitted in ICU are excluded from the study. The study was carried out for a period of 10 months from June 2011 to March 2012.

Data collection

Questionnaire is prepared based on the GINA, GOLDEN guidelines of asthma for data collection. The patients/caregivers were requested to answer the

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questionnaire which includes the demographical data of the patients. Parents were requested to answer about their occupation, monthly income, contact address and contact phone number. At the end of one month, the patients were recalled by telephonic interviews and collected information about child's health. Telephonic interviews were conducted at 1, 3, 6 months after registration during which questions were repeated and information from the parents was collected during the subsequent months. The telephonic interviews were coded and framed to concentrate specifically on respiratory-related resource use. Health services reporting consisted of respiratory-related visit to general practitioner, pulmonologist, pediatrics, emergency department, hospital admission, medication cost and travelling costs. All the interviews with parents were conducted in the presence of children who supplied information that the parents were unable to provide (severity of symptoms).Time to complete the questionnaire was usually between 15-20 minutes.

Cost measurement

The total costs for asthma were divided into direct and indirect costs. Costs were calculated by multiplying asthma related utilization by the unit cost. Since the true value of resource consumed is not available for most services and products, prices and fees were used. Direct medical costs consists of asthma related health services, privately insured complementary care, prescription medication and physician cost. Direct patient costs were out of pocket expenses related to asthma care. Indirect cost consisted of parent productivity losses resulting from disease related child care, and travel and waiting time. The total cost for each medication was calculated by multiplying the estimated annual number of prescriptions by the cost per prescription. Indirect cost was measured by multiplying the total time loss by the parents reported salary.

Statistical analysis

One-way anova method was used to explore the impact of explanatory variables on costs. These variables include medication cost, patient age, gender, parent occupation and disease severity. One way anova method determined which variables were statistically significant predictors of costs, using a p-value of 0.05 or less.

RESULTS

Table 1 shows the prevalence of asthma according to gender. Out of 158 pediatrics, 110 were found to be male and 48 were female patients. The education grades of the patient shows that, most of the patients are comes under pre-high school range, and the weight distribution shows that the patients under age 10 years was found to be most affected.

Table 2 shows that most of the patients have mild persistent asthma and most of the patients are atopic. 41.77% patients

Tabl 1: Prevalence of asthma according to sex		
Sex	**Number of Patients**	**Percentage (%)**
Male	110	70%
Female	48	30%
Frequency (n=158)		

Table 2: Characteristics of population		
Characteristics	**Number of patients**	**Percentage (%)**
Age in years		
0-5	54	34.5%
5-10	68	43.0%
10-15	36	22.5%
Family income one month		
Below 5000	24	15.18%
Between 5000-7500	60	37.97%
Between 7500-10,000	42	26.58%
Above 10,000	32	20.25%
Disease severity		
Mild intermittent	58	36.70%
Mild persistent	62	39.24%
Moderate or severe	38	24.05%
Co morbid disease		
Allergic rhinitis	46	29.11%
Mothers asthma	09	05.69%
Atopic dermatitis	03	00.01%
Atopy	66	41.77%
Frequency (n=158)		

are atopic shows that allergy is the main cause for paediatric asthma. Family income of the patients shows that most of the families belonged to middle class and their monthly income was below Rs.10,000/-. The present study shows that the most common clinical manifestation of paediatric asthma was found to be shortness of breath. 65.82% of total patient shows shortness of breath, followed by 59.49% patients experienced cough. Out of 158 patients, 102 received monotherapy and 56 got combination therapy, because most of the patients had mild persistent asthma. The male were more prone to combination therapy as compared to females. As mentioned early that the males are more prone to asthma as compared to female. The ratio of monotherapy to combination therapy in male was found to be 2:1 and in female patients, it was almost 1:1. This shows that the male are more prone to drug therapy as compared to female. When taken into account of antiasthmatic drug only, the highest percentage of cost was for inhaled corticosteroids (31.70%), followed by inhaled bronchodilators (29.51%) and leukotrine antagonists (25.19%). The most commonly used drug was found to be oral

bronchodilator, because it is less expensive and effective against asthma. Present study shows that inhaled corticosteroids (23.93%) were found to be the highest percentage cost followed by antibiotics (23.46%). The study shows that despite the highest cost of inhalation drugs, prescribers frequently used the inhalation drugs due to their effectiveness. The highest cost of these inhalation drugs is mainly due to the prescription of these drugs for 3, 6 months or for 1 year.

Table 3 shows the utilisation of common drug for asthma. The highest mean consumption of drug was found to be inhaled corticosteroid 1495.90 ± 7.03 followed by inhaled bronchodilator 1445.09 ± 5.04.

Table 4 shows that direct cost of asthma in paediatrics. The highest percentage cost was found to be medication cost; almost half of the cost was found to be medication cost and followed by hospitalisation cost accounts for 30.14% of the total cost. The mean consumption cost was found to be high in case of hospitalisation.

Table 5 shows the indirect cost of asthma. Parent work loss was found to be the highest percentage cost (43.80%), followed by the absence from school (39.81%). This study shows that the direct cost is very high as compared to the indirect cost. The present study shows that the direct cost is almost 8 times greater than the indirect cost. According to the age wise cost of asthma the paediatrics aged between 5-10 years accounts for 44.24% of total cost of asthma. The children aged between 5-10 years are more prone to asthma and aggressive therapies like inhalation therapy and therapy with leukotrine antagonist increases the cost of asthma. This high cost is mainly due to drugs and hospitalization.

Table 6 shows the cost of asthma by severity of disease. The highest percentage cost was found to be the moderate persistent asthma with 39.98% of total cost, followed by severe asthma with 34.89% of total cost. The costs of asthma for patient with moderate disease were almost twice as high as

Table 4: Direct cost of asthma

Direct cost	Percentage	Mean±SD	P Value
Medication cost	46.10%	2137.62 ± 7.37	0.0001**
Hospitalization++	30.14%	2505.59±4.30	0.0025*
G.P visit	10.12%	515.52±69.58	0.0001**
Clinic visit	01.98%	487.66±7.145	0.0655
Home care	00.96%	176.37±6.42	0.0587
Emergency visit+	06.05%	1136.92±25.77	0.0001**
Diagnostic test	04.18%	547.20±14.4	30.0001**
Ambulance service	00.43%	177.11±3.56	0.10

n= number of patients, +Mean cost of emergency visit (n=39), ++Mean cost of hospital admission (n=88), *p value 0.05 are significant, **p value 0.0001 are extremely significant

Table 5: Indirect cost of asthma

Indirect cost	Percentage Cost (%)	Mean±SD	P value
Travelling	11.91%	84.83±58.83	0.0001**
Work loss	43.80%	119.85±7.25	0.0001**
School Absentee	39.81%	73.79±3.16	0.10
Out of pocket	4.45%	32.01±14.72	0.0001**

Data's are available in mean± SD, *p value 0.05 are significant, **p value 0.0001 are extremely significant

for mild asthmatic patients. The mean cost consumption was found to be high in severe asthma. Table 6 shows that there is a relationship between severity of disease and increases in both the direct and indirect cost of asthma. This table also shows that as the severity increases the mean consumption cost of asthma also increased.

Table 7 shows the direct cost of asthma by severity of illness. This table shows that the mean consumption of direct cost was very high for severe asthma as compared to mild and moderate asthma. High mean consumption cost is for hospitalization 2505.59 ± 4.30; followed by drug cost 2137.62 ± 7.37. The difference in drug cost between patients with mild and severe asthma was probably because of

Table 3: Utilisation of common drug for asthma

Drugs	Number of patients	Mean±SD	Percentage Cost (%)	Pvalue
Antibiotics	72	1110±9.19	23.46%	0.0001**
Corticosteroid oral	70	245.64±4.23	05.11%	0.0001**
Bronchodilator oral	98	103.49±4.00	03.00%	0.0031*
Leukotrine antagonist	46	1396±6.44	19.01%	0.0194*
Antihistamine	10	720±23.57	02.13%	0.01
Inhaled bronchodilator	52	1445.09±5.04	22.27%	0.0231*
Inhaled corticosteroid	54	1495.90±7.03	23.93%	0.0005*
Analgesic	30	117±3.308	01.04%	0.01

Data's are available as mean± SD, *p value 0.05 significant, **p value 0.0001 are extremely significant

Table 6: Total cost of asthma by severity of illness

Degree of severity	Direct cost(%)	Indirect cost(%)	Total cost(%)
Mild intermittent (n=58)	1,87,550(25.62%)	19,956 (21.19%)	2,07,506(25.12%)
Moderate persistent (n=62)	3,00,200(41.1%)	30,100 (31.96%)	3,30,300(39.98%)
Severe (n=38)	2,44,100(33.35%)	44,120 (46.84%)	2,88,220(34.89%)
Total (n=158)	7,31,850	94,176	8,26,020
n= number of patient, Data's available in rupees,			

Table 7: Direct cost of asthma by severity of illness

Cost provided	Mild intermittent (n=58)	Moderate persistent(n=62)	Severe (n=38)	Total	P value
Drugs	1433.74 ± 306.13	1934.20 ± 9.79	3314.94 ± 521.55	2137.62 ± 7.37	0.0001**
Hospitalisation	1132.56 ± 8.09	3207.66 ± 159.22	4221.05 ± 4.057	2505.59 ± 4.30	0.0025*
G.P visit	346.55 ± 24.20	457.41 ± 17.20	674.73 ± 32.20	515.52 ± 69.38	0.0001**
Clinic visit	183.33 ± 4.02	630.01 ± 7.58	757.5 ± 9.10	487.66 ± 7.145	0.0655
Home care	92.85 ± 1.02	212.50 ± 6.10	230.0 ± 2.23	176.37 ± 6.42	0.0587
Emergency visit	472.0 ± 14.32	1225.26 ± 28.22	1634.0 ± 34.10	1136.92 ± 4.51	0.0001**
Diagnosis	675,10 ± 5.34	555.21 ± 7.52	235.71 ± 2.24	547.20 ± 14.43	0.0001**
Ambulance	101.20 ± 1.14	195.10±7.34	228.24 ± 14.32	177.11 ± 3.56	0.01
n= number of patients, Data's are available in mean±SD, *p value 0.05 are significant, **p value 0.0001 are extremely significant					

inhalation drugs. The mean consumption cost for hospital admission in severe asthma was almost thrice as compared to moderate asthma, which shows that the patient admission was higher in case of severe asthma.

DiscussionCost analysis is an inexact science. Both measurement error and methodological disagreement introduce uncertainty into the estimates. Imprecision or inconsistency in the definition of asthma may affect questionnaire data, medical data and dispensing data. Finally disagreement about costing methods, particularly methods of determining indirect costs, makes it difficult to compare estimates from different cost-analysis studies.

This study differs from recently published studies of the cost of asthma in several important ways. First this study was more complete, the cost associated with travelling time and school absences are included in this study. Study also included cost associated with ambulance service and outpatient diagnostic service.

This study attempted to estimate the cost of pediatric asthma in a tertiary care hospital in Kerala showed that the total cost of asthma for 9 months was found to be Rs.8,26,020 lakhs, which accounts for 16% of the 9 month income of a family. The majority of cost comes from medication cost (46.10%) and hospital admission cost (30.30%). The predictors of cost of childhood asthma appeared to be disease severity, current use of preventive drug and having current use of emergency care or current hospitalization. These findings provide

insights into the cost of pediatric asthma and may hopefully direct policy decision towards a better management of the disease.

In this study, the mean cost of hospital admission was found to be Rs.2505.59 ± 4.30.The hospital admission cost and medication cost accounts for the 77% of the total direct cost of asthma. Direct cost is far away as compared to the indirect cost. Direct cost for asthma accounts for approximately 7 times more than that of indirect cost of asthma.

The patients in the present study were treated according to best practice by their primary care practitioner who followed international recommendations, and they were also assessed expertly and regularly. However, effective asthma control reduces cost particularly by decreasing hospitalization. Weiss *et al* recently pointed out that, "the number of hospitalizations will fall when national treatment guidelines are followed", and cost of asthma are, "largely due to uncontrolled disease, indicating that current therapies are either underused or misused in practice[7].

Fleisher *et al*., found that in early childhood, asthma is more common among males, but after puberty the incidence increases in females and decreases in male. In addition, asthma after childhood is more severe in female than in male.[8] Our study also confirmed that the male are more prone to asthma. This study shows that the bronchodilators and corticosteroids for inhalation were the drugs used more often and accounted for 90% of all drug cost in patients. Buxton *et*

al, showed that salbutamol was more cost effective than formeterol because of its lower acquisition cost.[9] Our study also revealed that salbutamol was the most commonly prescribed drug for pediatric asthma.

Krahn *et al,* showed that increase use of more expensive combination inhalers have likely contributed to the rising costs of asthma medications in recent years.[10] Smith *et al.,* showed that recent data suggest that inhaled beta agonists are the most frequently used medication[11], it is expected that the therapy patterns have shifted towards greater use of inhaled corticosteroids. This study shows that drugs cost makes approximately 37% of total direct cost of asthma, and represents the major cost for mild-to-moderate asthmatic patients. More aggressive therapy with inhaled corticosteroids, inhaled bronchodilators and new therapies such as leukotrine antagonist may cause shifting of high medication cost. Hospital cost is mainly incurred by patients with moderate to severe asthma, and hospitalization usually occurs when the management of asthma failed to prevent an acute attack, which is expensive to rectify. This study shows that the cost of one admission to hospital pays for 3 years of treatment with the inhaled corticosteroids.This study also shows that children accounted for a high percentage of indirect cost, reflecting the importance of time spent by others to care for children. Our study also reported that indirect cost accounts for almost 12% of the total direct cost of asthma. Indirect cost depends on the patient age and severity of disease. The costs of asthma for patient with moderate disease were almost twice as high as for mild asthmatic patients. The mean cost consumption was found to be high in severe asthma. This study shows that there is a relationship between severity of disease and increases in both the direct and indirect cost of asthma. This study concluded that as the severity increases the mean consumption cost of asthma also increased. Mean consumption cost for severe asthma was found to be almost thrice as compared to moderate asthma. The drug cost and hospitalization cost was found to be high. The differences in the drug cost between patients with mild and severe asthma were probably because of inhalation drugs.

CONCLUSION

This study revealed the burden of direct cost on the patient's family and on society. For a disease for which effective prophylactic therapies exist, much of the cost of asthma relates to cost which could be avoided or reduced by improved disease control. Indirect cost is incurred when the disease is not fully controlled. Direct costs, are amendable to reduction by improved disease control. Study revealed that the asthma hospitalization can be decreased as inhalation therapy use increased. Inhalation drugs can be used individually by the patients at home, so the travelling cost, GP visit cost can be minimized and as a result hospitalization can also be reduced. Patient education programs showed reduction in hospitalizations, GP visits, emergency admissions, and time of work and school and the monetary savings have always been reported. It is necessary to emphasize the importance of appropriate management of the disease, with the use of effective continued treatment in accordance with the level of severity. The patients with moderate asthma can be treated with monotherpy and in case of severe disease the combination therapy is required. This approach would probably improve patients quality of life, decreases the number and severity of attacks, and minimize the cost of asthma.

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